

ELASTOMERIC HINGED SEAL

BACKGROUND OF THE INVENTION

[0001] The invention relates generally to hydrodynamic seals and, more particularly, to a hydrodynamic seal that surrounds a rotating part.

RELATED PRIOR ART

[0002] Hydrodynamic seals can engage a rotating shaft to contain oil or grease in a desired location. Common applications for such seals include engine crankshafts and transmission shafts. The seal can be supported by an elastomeric member that can resiliently deform. The elastomeric member can deform to enhance the likelihood that the seal will stay in continuous, intimate contact with the shaft despite any lack of concentricity between the rotating shaft and the structure supporting the seal. The seal can be formed from polytetrafluoroethylene and be bonded to the elastomeric member along its entire length.

SUMMARY OF THE INVENTION

[0003] The present invention provides a seal including a first portion connected to an elastomeric member and a second portion extending past the elastomeric member along the length of the shaft. Both portions of the seal are in sealing engagement with the shaft. The first and second portions can be formed from polytetrafluoroethylene.

[0004] The present invention also provides a seal having an annular living hinge portion. The hinge portion can extend between the first portion and the second portion and can extend past the elastomeric member. The hinge portion can be defined by an outwardly facing annular notch.

[0005] Other applications of the present invention will become apparent to those skilled in the art when the following description of the best mode contemplated for practicing the invention is read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The description herein makes reference to the accompanying drawings wherein like reference numerals refer to like parts throughout the several views and wherein:

[0007] Figure 1 is a partial cross-sectional view of the seal according to a preferred embodiment of the invention shown in sealing engagement with a rotatable shaft;

[0008] Figure 2 is a partial cross-sectional view of the seal shown in Figure 1 disengaged with respect to the rotatable shaft;

[0009] Figure 3 is a partial cross-sectional view of an alternative embodiment of the seal according to the present invention;

[0010] Figure 4 is a partial cross-section view of a second alternative embodiment of the seal according to the present invention; and

[0011] Figure 5 is a partial cross-sectional view of a third embodiment of the seal according to the present invention.

DETAILED DESCRIPTION

[0012] Referring now to Figures 1 and 2, the present invention provides a seal assembly 10 including an annular flexible support member 24 and a seal 32. The annular flexible support member 24 includes a lip 28 defining an annular supporting

surface 30 extending from a first edge 60 to a second edge 62. The seal 32 includes a first collar portion 34 connected to the annular support surface 30. The first collar portion 34 defines a first sealing surface 40. The seal 32 can extend past the edge 62 of the lip 28 to an end 50, defining a second collar portion 38. The second collar portion 38 can extend past the annular supporting surface 30 and define a second sealing surface 46.

[0013] The seal 32 can engage and seal against a rotatable shaft 12, or a wear sleeve 14 immovably associated with the shaft. The wear sleeve 14 can encircle the rotatable shaft 12 and define an outwardly facing annular sealing surface 16. The sealing surfaces 40, 46 can contact and seal against the surface 16. The surfaces 16, 30, 40, 46 can be concentric with respect to one another.

[0014] The seal 32 can be supported for engagement with the shaft 12 by a carrier 18 in combination with the annular flexible support member 24. The carrier 18 can include a tubular portion 20 spaced from and substantially concentric with the wear sleeve 14. The carrier 18 can also include a radial flange portion 22 extending from the tubular portion 20. The radial flange portion 22 can define an aperture 26. A portion 52 of the annular flexible support member 24 can define a channel 54 for receiving an end 29 of the flange portion 22 at the aperture 26. The portion 52 can be immovably associated with respect to the aperture 26.

[0015] The annular elastomeric member 24 can include a living hinge portion 58 disposed between the lip 28 and the portion 52. The living hinge 58 promotes continuous engagement between the seal 32 and the wear sleeve 14 when the shaft 12 and the tubular portion 20 become misaligned. The annular flexible support member

24 can flex and resiliently deform about the living hinge portion 58 to enhance the likelihood that the surfaces 40, 46 maintain continuous, intimate engagement with the surface 16. The elastomeric member 24 can also include a debris lip 56.

[0016] The first and second collar portions 34, 38, can be integrally formed with respect to one another. Both portions 34, 38 can be formed from polytetrafluoroethylene. One or both of the portions 34, 38 can include hydrostatic aids 42 to direct oil in a desired direction. For example, the seal 32 can include grooves or channels as disclosed in U.S. Patent No. 6,168,164; said patent being hereby incorporated by reference. Alternatively, as shown in Figure 3, the seal 32a can define grooves 66 adjacent a second end 50a and define a substantially flat sealing surface adjacent the portion 34a. Alternatively, as shown in Figure 4, the seal 32b can define a substantially flat sealing surface between the portion 34b and the end 50b. Alternatively, as shown in Figure 5, seal 32c can include either concentric or spiral grooves 66a adjacent an end 50c as well as U-shaped projections 68 extending outwardly from the seal 32c.

[0017] Referring now to Figures 1 and 2, the seal 32 can also include a living hinge portion 36 disposed between the portions 34, 38. The living hinge portion 28 can define an annular, outwardly facing notch 64. The living hinge portion 36 can enhance the flexibility of the seal 32 and can also reduce the likelihood of failure. For example, the hinge portion 36 can facilitate flexing of the seal 32. The living hinge portion 36 can define a sealing surface 44. The sealing surfaces 40, 44, and 46 can be integrally formed to define a substantially continuous sealing surface.

[0018] While the invention has been described in connection with what is presently considered the most practical and preferred embodiment, it is to be understood that the invention is not to be limited to the disclosed embodiments. On the contrary, it is intended that the present application is intended to cover various modifications and equivalent arrangements included within the scope and spirit of the claims. The claims are to be accorded the broadest possible interpretation so as to encompass all such modifications and equivalent structures as permitted under law. It is also to be understood that any feature of the disclosed embodiments can be used in combination with any other feature of any of the other embodiments.